REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From – To)*
18 Jun 2012	Consultative Letter	Oct 2011 – May 2012

4. TITLE AND SUBTITLE

Review of Hangar Door Design of Mountain Home AFB (MHAFB) Refurbished Non-Destructive Inspection (NDI) Facility

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
Capt Andrew McUmber

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
USAF School of Aerospace Medicine
Occupational and Environmental Health Dept
Radiation Health Consulting Section
2510 Fifth St.
Wright-Patterson AFB, OH 45433-7913

8. PERFORMING ORGANIZATION REPORT NUMBER

AFRL-SA-WP-CL-2012-0056

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSORING/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION / AVAILABILITY STATEMENT

Distribution A: Approved for public release; distribution is unlimited. Case Number: 88ABW-2012-3228, 14 Jun 2012

13. SUPPLEMENTARY NOTES

14. ABSTRACT

The U.S. Air Force School of Aerospace Medicine, Radiation Health Branch, Radiation Health Consulting Section, performed a partial assessment of the design of the refurbished non-destructive inspection facility at Mountain Home AFB at the request of Maj Michael Horenziak, 366 AMDS/SGPB. The request was to evaluate the thickness of shielding materials for the main sliding hangar doors of the facility. Several radiography unit orientations for aircraft inspection were considered.

15. SUBJECT TERMS

Occupational health, consulting, ionizing radiation protection, exposure, shielding, primary barrier, attenuation, occupancy factor, workload, nondestructive inspection (NDI), x-ray, scatter, LORAD LPX-160, aircraft, health physics, health risk assessment, refurbished, consultative letter, USAF School of Aerospace Medicine (USAFSAM), customer support, gypsum, specialty drywall, site design, tube orientation, main hangar door, unrestricted area requirements, public dose, bioenvironmental engineering, facility modification, industrial radiography, technique settings, air-KERMA,RSO

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Col Mark E. Smallwood
U	U	U	SAR	16	19b. TELEPHONE NUMBER *(include area code)*

DEPARTMENT OF THE AIR FORCE
USAF SCHOOL OF AEROSPACE MEDICINE (AFMC)
WRIGHT-PATTERSON AFB OH

18 June 2012

MEMORANDUM FOR 366 AMDS/SGPB
ATTN: Maj Michael Horenziak
Mountain Home AFB, ID 83648

FROM: USAFSAM/OEHHH
2510 Fifth Street, Building 840
Wright-Patterson AFB, OH 45433-7913

SUBJECT: Consultative Letter AFRL-SA-WP-CL-2012-0056, Review of Hangar Door Design of Mountain Home AFB (MHAFB) Refurbished Non-Destructive Inspection (NDI) Facility

References: (a) AFIOH Consultative Letter (IOH-SD-BR-CL-2007-0037), 30 March 2007
(b) T.O. 33B-1-1, 21 October 2011
(c) Turner, James E. Atoms, Radiation, and Radiation Protection, 3rd Ed. 2007.

1. The U.S. Air Force School of Aerospace Medicine (USAFSAM), Radiation Health Branch (OEHH), Radiation Health Consulting Section (OEHHH), performed a partial assessment of the design of the refurbished NDI facility at MHAFB at the request of Maj Michael Horenziak, 366 AMDS/SGPB. The request was to evaluate the thickness of shielding materials for the main sliding hangar doors of the facility. Several radiography unit orientations for aircraft inspection were considered.

2. The evaluation was based on the following information provided by 366 AMDS/SGPB.

a. The entire NDI facility will be located inside an aircraft hangar. The main hangar bay will serve as the exposure room for aircraft. The main hangar doors are oriented on the east wall. The width of each door is approximately 42 ft, for a total span of 84 ft.

b. The outdoor enclosure on the eastern side will be occupied by non-NDI personnel and, thus, must meet unrestricted area requirements. Aircraft exposures will be directed in several orientations (upward, downward, horizontal, and diagonal). Therefore, the main hangar doors require shielding as primary barriers.

c. The x-ray device to be used is a Lorad LPX-160.

(1) Technique settings

(a) 2 aircraft/mo ≈ 0.5 aircraft/wk

(b) 3 to 50 exposures/aircraft (assume worst-case)

(c) 15 to 50 sec/exposure = 0.25 to 0.83 min/exposure (assume 1 min/exposure)

(d) 120 kVp @ 5.0 mA (assume 200 kVp @ 5.0 mA)

(2) Projected maximum (worst-case) workload

(a) $W = \left[mA\left(\frac{aircraft}{wk}\right)\left(\frac{exposures}{aircraft}\right)\left(\frac{min}{exposure}\right)\right]$ (1)

(b) $W = [5.0(0.5)(50)(1)] = 125\frac{mA{\cdot}min}{wk}$

d. The tube head will not be in a fixed position, but the distance between the tube head and the main hangar doors will be a minimum of 15 ft (4.57 m). The elevation of the tube will vary between 0 ft and 18 ft. Exposure angles of 0°, 45°, 90°, and 180° relative to the floor will be used.

e. MHAFB plans to use $^{5}/_{8}$-in specialty drywall. This specialty drywall can be ordered with a custom lead thickness within it. Per NCRP-147, one sheet of plain, $^{5}/_{8}$-in drywall is approximately equal to $^{1}/_{32}$-in of lead for the purposes of x-ray attenuation. Thus, the attenuation properties of the proposed lead-lined drywall include the attenuation factor due to the gypsum material itself. Basic building materials already in place such as $^{1}/_{8}$-in steel main hangar doors may provide limited shielding properties. However, shielding properties of the steel or other materials are not considered in this evaluation.

f. USAFSAM/OEHHH (AFIOH/SDRH) has previously evaluated the Lorad LPX-160 system at other locations, and historically it has an average output of 60 R/min at a distance of 1 m.

3. Findings

a. In accordance with T.O. 33B-1-1, *Nondestructive Inspection,* AFI 48-148, *Ionizing Radiation Protection*, and NCRP-116, *Limitation of Exposure to Ionizing Radiation,* persons in uncontrolled areas should not receive a dose in excess of 100 mrem/yr. Therefore, the weekly dose limit is 2 mrem/wk for a 50-wk working year. Additionally, the dose shall not exceed 2 mrem in any one hour.

b. All calculations were done using the assumptions that the tube head would be oriented toward the main sliding hangar doors (maximum use factor) with a minimum distance of 15 ft, that there would be full-time occupancy outside the hangar doors (maximum occupancy factor), and extended exposure times would be used (maximum workload, see Equation 1). A maximum kilovolt-peak setting was used in the interpolation of attenuation curves for lead.

c. Design of NDI primary barrier (main hangar doors)

(1) $Q = 0.114\frac{Pd^2}{WUT} = 0.114\frac{(0.02)(4.57)^2}{(125)(1)(1)} = 0.00038\frac{R}{mA{\cdot}min}$ (2)

where the following factors are:

Q = exposure of lead-attenuated radiation
P = Air-Kerma shielding design goal (unrestricted)
d = tube-to-door distance
W = maximum workload
U = use factor
T = occupancy factor

(2) Figure 15.9 of Reference (c) gives 3.5 mm Pb (0.138 in Pb) as needed for Q = 0.00038 (Equation 2). This interpolation assumes the use of a 200-kVp beam.

(3) With the use of $^{5}/_{8}$-in drywall, approximately $^{1}/_{32}$ in (0.0313 in) of lead-equivalent material is provided by the gypsum itself. Thus, the lead lining required to achieve a total of 0.138 in Pb (or lead-equivalent) is 0.138 – 0.0313 = 0.107 in Pb.

d. There was no information provided concerning the design of the secondary barriers (walls to the north, south, west, or ceiling). There was no information available regarding x-ray scatter from aircraft. No additional exposure rooms in the facility are being designed at this time.

4. Recommendations

a. This evaluation recommends using $^{5}/_{8}$-in specialty drywall, which contains at least 0.107 in Pb. If this is used, the primary barrier design is sufficient to prevent personnel from exceeding the 100-mrem/yr limit (based on the supplied information and stated assumptions). The facility should have a radiation survey performed and documented prior to initial operations per T.O. 33B-1-1, *Nondestructive Inspection Methods, Basic Theory*.

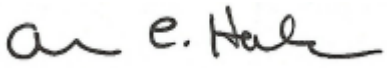
b. This evaluation was based on the assumption that the NDI room would have a maximum usage of 100 exposures per month. These calculations are only valid with the Lorad LPX-160. Usage of the facility in means other than described above would require further evaluation from USAFSAM/OEHHH or the Installation Radiation Safety Officer.

c. Any questions or comments regarding this consultation may be directed to Capt Andrew McUmber at (937) 938-3317 (DSN 798-3317), or andrew.mcumber@wpafb.af.mil.

Prepared by:

ANDREW J. MCUMBER, Capt, USAF, BSC
Health Physics Consultant

Reviewed by:



ALAN C. HALE, Maj, USAF, BSC
Chief, Radiation Health Consulting

2 Attachments:
1. Memo, Maj Michael Horenziak, 3 October 2011
2. Ionizing Radiation Scatter Survey, 15 September 2011

ATTACHMENT 1

NDI SCATTER SURVEY LETTER

DEPARTMENT OF THE AIR FORCE
366TH AEROSPACE MEDICINE SQUADRON (ACC)
MOUNTAIN HOME AIR FORCE BASE IDAHO

3 Oct 11

MEMORANDUM FOR 366 EMS/MXMFM

FROM: 366 AMDS/SGPB

SUBJECT: Radiation Scatter Survey at Bldg 1335 Non-Destructive Inspection, WIC: 0136-FAND-461A

1. On 15 Sep 11, Major Horenziak and Capt Schneekloth from Bioenvironmental Engineering (BE) conducted several radiation scatter surveys of the Non-Destructive Inspection (NDI) X-Ray operations inside Bldg 1335 located at MHAFB. These surveys were accomplished to evaluate potential radiation exposures in Bldg 1335 during routine aircraft X-ray operations. We express our special thanks to NDI personnel who assisted BE with this survey.

2. Survey Equipment: BE personnel used an Inovision, model 451P-RYR (pressurized ion chamber, calibrated 01 Apr 11 during this survey. Background readings were taken around the perimeter of Bldg 1335 before the tube head was activated. Background levels ranged between 4-10 micro-Roentgens per hour (μR/hr). Readings taken in μR/hr were converted to milli-Roentgen (mR/hr) and milli-Roentgen Equivalent Man (mrem).

3. Results: Measurements were taken while the LORAD Industrial Imaging LPX160 tube head was activated at 120 kVp energy level. Readings were taken from various locations (operators position, office area adjacent to hanger bay and perimeter outside of Bldg 1335), during 4 different X-ray shots (shooting directly down, directly up, 45 degrees and 18 ft high stabilizer shots towards the side walls). All shots were taken with the x-ray unit on the ground with the exception of the stabilizer shot which was taken on the top of a maintenance stand. No aircraft was in the hangar during this survey, therefore all shots were simulated and taken in the same manner they would have been if an aircraft had been present. This survey identifies exposures for flight personnel to be below the occupational dose rate of 5000 mrem/year. It exceeds the general public dose limit of 2 mrem/hr but below 100 mrem/yr, in accordance with AFI 48-148, Chapter 5, *Radiation Protection of the General Public* and TO 33B-1-1, Chapter 6, *Radiation Protection.*

4. Based on this survey, BE does not recommend that NDI personnel perform X-Ray operation in Bldg 1335 for the following reasons:

a. NDI personnel stated that they do not have authority to vacate non-NDI personnel from the south offices (see attachment).

b. The hazard zone extends beyond 200ft and NDI personnel do not have the capability/authority to control/restrict this large of a cordon area around the bldg.

c. The x-ray operator needs additional shielding and must move to the opposite side of aircraft as the direction of the x-ray (i.e. if the x-ray unit is pointed south the operator must be on the north side of the building) during the 18ft stabilizer shots and the 45 degree angular shots.

5. NDI personnel have asked BE if the addition of a 10 ft concrete wall would mitigate the x-ray hazard to the surrounding population/untrained workers. It is BE's opinion that a 10 ft wall of concrete would not sufficiently reduce hazards to the surrounding area. BE bases this opinion on the results of this survey, especially the readings during the 18 ft shots and the 45 degree angle shots; both shots offer evidence that the x-ray beam loses collimation quickly and these shots also suggest a large production of scatter x-rays. For these reasons, BE recommends that if a wall is used to attenuate the x-ray energy, the wall should rise to the ceiling of the building to minimize beam-spread during the 18 ft shots and to minimize scattered x-rays from bouncing/travelling unimpeded over the wall. The minimum thickness of this wall should be 11 cm thick of concrete (or equivalent) and it should be noted that the calculations contained within the attachment to this document may not fully account for scatter x-ray production.

6. This survey should be made available to all NDI personnel. If you have any questions concerning this report, please contact Captain Schneekloth or myself at DSN 728-7270.

MICHAEL W. HORENZIAK, Maj, USAF, BSC
Installation Radiation Safety Officer

Attachment:
Scatter Survey Forms

ATTACHMENT 2

NDI SCATTER SURVEY FORM

MHAFB Bioenvironmental Engineering

General Purpose Ionizing Radiation Scatter Survey

Date of scatter survey: 15 Sep 2011
Workplace Identifier: 0136-FAND-461A
Installation: MHAFB
Organization: 366 EMS/MXMFN- NDI
Point of contact & Phone No: Tsgt Rodriguez DSN: 728-6182
Building Number: 1335 Room/Area: N/A

Ionizing Radiation Survey Instruments:

Manufacturer	Model	Serial No.	Calibration Date	Due Date
1. Inovision	451P-RYR	0000003472	20110401	20111001
2. Inovision	451P-RYR	0000003957	20110712	20120112
3. Inovision	450P	0000004472	20110415	20111015

Comments:

X-Ray Equipment:

Tube Head Manufacturer	Model	Serial No.	Max kVp	Max mA
1. LORAD	LPX160	XX3753882	120	5.0

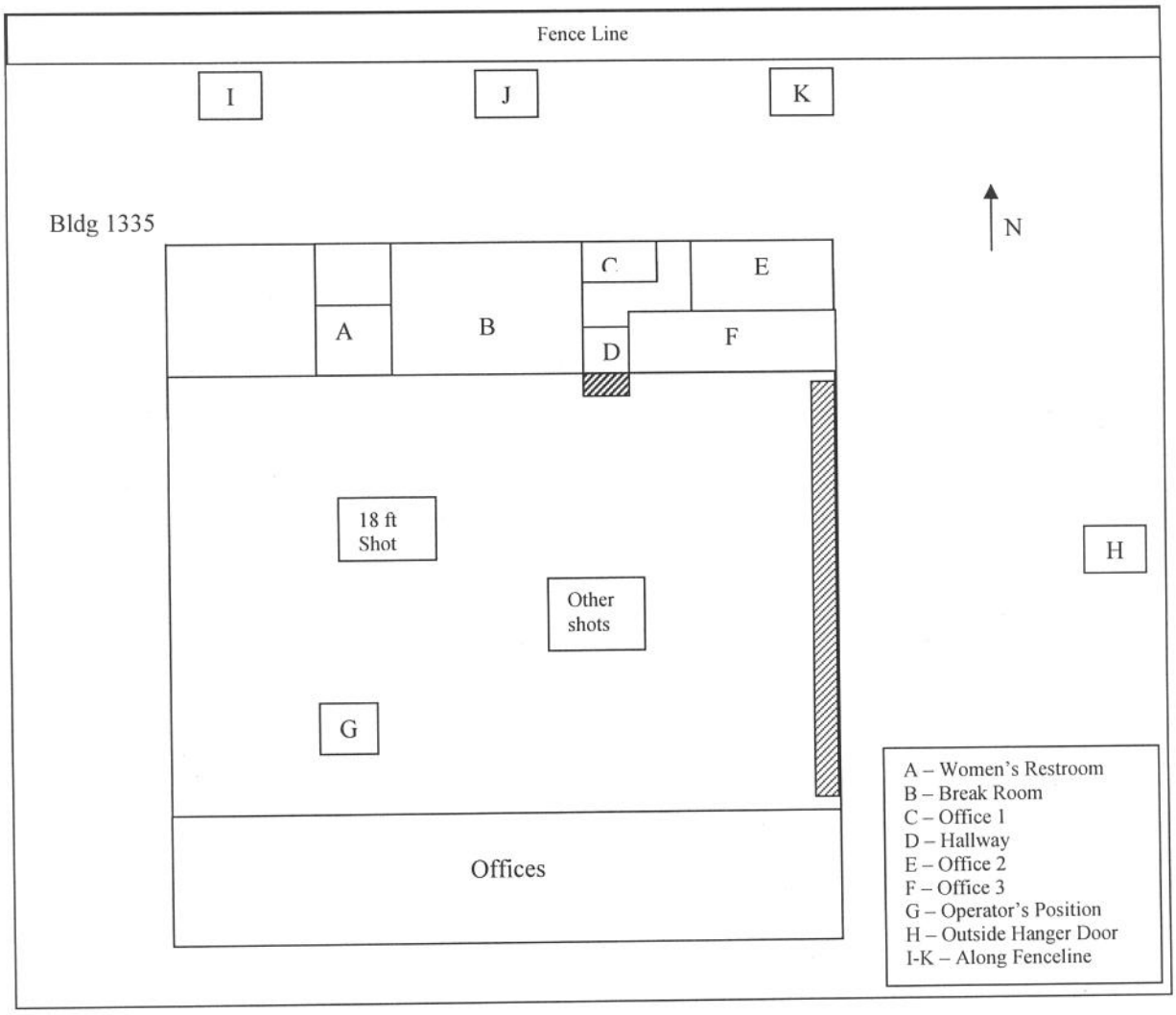
Console Manufacturer	Model	Serial No.
1.. LORAD	LPX160	0194128

Comments:
Normal operations do not exceed 120 kVp and 5.0 mA, at this power a shot normally lasts 15-20 seconds.
Max duration is typically at 50 sec but at lower power (100 kV, 4 mA)
During survey—readings taken at 120 kV, and 5.0 mA. Duration was extended for several minutes to allow time for readings in and around Bldg 1335. Readings were taken with beam shooting directly down, directly up, 45 degrees and 18ft off the ground-stabilizer shots-directly towards the side wall/office area. All shots were taken **without** an **Aircraft** in Bldg 1335

Ionizing Radiation Sources/Emitters: X- Rays

a) Anywhere from 3 to 50 shots Max/ Aircraft.
Shot duration is 15-60 sec per shot

b) Worst Case- Frequency 2/month. 100 shots/month x 60 sec x 12 months/yr = 72000 sec = 20 hrs/yr


Fence Line
I
J
K
Bldg 1335
N
A
B
C
D
E
F
18 ft
Shot
Other
shots
H
G
Offices
A – Women's Restroom
B – Break Room
C – Office 1
D – Hallway
E – Office 2
F – Office 3
G – Operator's Position
H – Outside Hanger Door
I-K – Along Fenceline

Radiation Measurements:
max readings reported below *from 4 shots (aiming down, up, 45 degrees and18ft stabilizer shot to side wall of Bldg 1335)*

Background Reading: 0.004 - 0.010 mR/hr

Location	Radiation Level (mR/hr)				
	Straight Down	**Straight Up**	**45 degrees**	**18 ft Stabilizer Shot Facing North**	**18 ft Stabilizer Shot Facing South**
A	0.036	0.20	0.50	No Data	No Data
B	0.058	0.24	0.90	> 2.3	No Data
C	0.060	0.10	0.38	No Data	No Data
D	0.070	0.25	1.5	No Data	No Data
E	No Data	0.10	0.36	No Data	No Data
F	0.070	0.25	1.2	> 2.0	No Data
G	2.10	1.3	1.6	No Data	15
H	Background	0.42	0.92	No Data	No Data
I	No Data	No Data	No Data	0.61	No Data
J	No Data	No Data	No Data	0.9	No Data
K	No Data	No Data	No Data	0.56	No Data

Radiation Exposure Calculations:

Annual Exposure = scatter reading (mR/hr) x number of shots/ yr x shot time (seconds) / 3600 seconds/hr

Operator's Exposure straight down shot = 2.1 mR/hr x 1200 shots/yr x 50 seconds / 3600 seconds/hr = **35 mR/yr**

North Office Worker/South Office Public Exposure[1] (All shots assuming worst case exposure of 18ft stabilizer) = 2.3 mR/hr x 1200 shots/yr x 50 seconds / 3600 seconds/hr = **38 mR/yr**

Public Exposure at point H (All shots assuming worst case exposure of 45 degree angle shot) = 0.92 mR/hr x 1200 shots/ yr x 50 seconds / 3600 seconds/hr = **15.33 mR/yr**

Public Exposure at point J (All shots assuming worst case exposure of 45 degree angle shot) = 0.9 mR/hr x 1200 shots/ yr x 50 seconds / 3600 seconds/hr = **15 mR/yr**

Will workers or the general public receive more than 2 mrem in any one hour or 100mrem/year? Yes

Thickness of concrete needed to nominally reduce public exposure at point H to less than 2 mR/hr
$\ln (I/I_0) = -\mu * t = \ln(35)/ 0.326$ = **11 cm thick**[2,3,4]

Thickness of concrete needed to nominally reduce public exposure at point J to less than 2 mR/hr
$\ln (I/I_0) = -\mu * t = \ln(10)/ 0.326$ = **7.1 cm thick**[2,3]

Comments: _____

1. South office public exposure assumes exposure rates will be equal to those measured in the north offices
2. Concrete attenuation values obtain from "Introduction to Health Physics", Herman Cember. 3rd ed. 1996
3. Assumes a 30% safety factor for the production of scatter x-rays
4. Assumes an additional 30% safety factor as not all measurements were taken in the north offices due to safety concerns

Preparer's printed name, signature, and date: Douglas N Schneekloth, 20SEP11

Reviewer's printed name, signature, and date: Michael W. Horenziak, 20Sep11

AIR FORCE PRIMARY STANDARDS LABORATORY

CERTIFICATE OF CALIBRATION

Report Number: 110900096 **Department:** Photonics/Nucleonics **Date of Issue:** 20110401

Calibration Item:
Manufacturer: FLUKE BIOMEDICAL
Model/Part No.: 451P SERIES
Equipment Type: ION CHAMBER SURVEY METER
Serial Number: 0000003472
ID Number: M213011

Equipment Submitted by:
366 CMS/MXMD
680 LIBERATOR ST.
MT HOME AFB, ID, 83648-5416

Item Condition:
As Received: IN-TOLERANCE
The measured values of all parameters tested or calibrated were found to be within specification limits.

As Returned: IN-TOLERANCE
Item was calibrated and returned in-tolerance. This includes TO directed limitations.

Room Ambient Conditions:
Temperature: 71.77 °F Relative Humidity: 34.7 % Barometric Pressure: N/A

Remarks:

Traceability: Measurement standards and test equipment used are traceable to the International System of Units (SI) through the National Institute of Standards and Technology, to the extent allowed by the Institute's calibration facilities; or to other National Metrology Institutes (NMI); or have been derived from accepted values of natural physical constants; or mutual consent standards; or have been derived by the ratio or reciprocity type measurement techniques.

General Conditions:
1. The standards and calibration program of the AFPSL, as operated by The Bionetics Corporation, Newark Metrology Operations, complies with the requirements of the current version of ISO/IEC 17025 on the date of calibration.
2. This report may not be reproduced, except in full, without written approval of The Bionetics Corporation, Newark Metrology Operations.

Calibrated By:
Mark Cooperrider **Metrology Technician**

AF P 484 S L

Phone: (740) 788-5451
E-mail: Mark.Cooperrider.ctr@afmetcal.af.mil

Approved By:
Curtis A. Brissette **Metrology Technician**

AF P 467 S L

Phone: (740) 788-5451
E-mail: Curtis.Brissette.ctr@afmetcal.af.mil

bionetics
VISION • VALUE • INTEGRITY

813 Irving-Wick Drive West, Heath, Ohio 43056-6118 TEL: (740) 788-5400 FAX: (740) 788-5404

Report Number: 110900096
Date of Issue: 20110401
Model/Part No.: 451P SERIES
Serial Number: 0000003472

Procedures and Equipment Used

PROCEDURES

Procedure	Date
33K7-4-93-1	30 Nov 2003

EQUIPMENT

Nomenclature	Model/Part No.	ID No.	NIST Report No.	Cal Due Date
CESIUM-137 STANDARD	81-10	P71210	N/A	20110904

The reported value(s) and uncertainties resulting from the measurement process are:

Report of Measurement

Range mR/hr	Applied mR/hr	T.I. Reading mR/hr
0 - 0.5	0.4	0.401
0 - 5	1.0	1.00
0 - 5	4.0	4.09
0 - 50	10.0	10.0
0 - 50	40.0	39.7
0 - 500	100	100
0 - 500	400	394
R/hr	R/hr	R/hr
0 - 5	1.0	0.99
0 - 5	4.0	4.25

- The instrument calibration results are accurate to within ±10% of reading between 10 and 100% full scale on any range, exclusive of energy response.

bioneics
VISION • VALUE • INTEGRITY
813 Irving-Wick Drive West, Heath, Ohio 43056-6118 TEL: (740) 788-5400 FAX: (740) 788-5404

AIR FORCE PRIMARY STANDARDS LABORATORY

CERTIFICATE OF CALIBRATION

Report Number: 111920139 **Department:** Photonics/Nucleonics **Date of Issue:** 20110712

Calibration Item:
Manufacturer: FLUKE BIOMEDICAL
Model/Part No.: 451P SERIES
Equipment Type: ION CHAMBER SURVEY METER
Serial Number: 0000003957
ID Number: M192298

Equipment Submitted by:
366 CMS/MXMD
680 LIBERATOR ST.
MT HOME AFB, ID, 83648-5416

Item Condition:
As Received: IN-TOLERANCE
The measured values of all parameters tested or calibrated were found to be within specification limits.

As Returned: IN-TOLERANCE
Item was calibrated and returned in-tolerance. This includes TO directed limitations.

Room Ambient Conditions:
Temperature: 72.97 °F Relative Humidity: 45.2 % Barometric Pressure: N/A

Remarks:

Traceability: Measurement standards and test equipment used are traceable to the International System of Units (SI) through the National Institute of Standards and Technology, to the extent allowed by the Institute's calibration facilities; or to other National Metrology Institutes (NMI); or have been derived from accepted values of natural physical constants; or mutual consent standards; or have been derived by the ratio or reciprocity type measurement techniques.

General Conditions:
1. The standards and calibration program of the AFPSL, as operated by The Bionetics Corporation, Newark Metrology Operations, complies with the requirements of the current version of ISO/IEC 17025 on the date of calibration.
2. This report may not be reproduced, except in full, without written approval of The Bionetics Corporation, Newark Metrology Operations.

Calibrated By:
Mark Cooperrider **Metrology Technician**

Phone: (740) 788-5451
E-mail: Mark.Cooperrider.ctr@afmetcal.af.mil

Approved By:
Curtis A. Brissette **Metrology Technician**

Phone: (740) 788-5451
E-mail: Curtis.Brissette.ctr@afmetcal.af.mil

Bionetics
VISION • VALUE • INTEGRITY
813 Irving-Wick Drive West, Heath, Ohio 43056-6118 TEL: (740) 788-5400 FAX: (740) 788-5404

Report Number: 111920139
Date of Issue: 20110712
Model/Part No.: 451P SERIES
Serial Number: 0000003957

Procedures and Equipment Used

PROCEDURES

Procedure	Date
33K7-4-93-1	30 Nov 2003

EQUIPMENT

Nomenclature	Model/Part No.	ID No.	NIST Report No.	Cal Due Date
CESIUM-137 STANDARD	81-10	P71065	N/A	20140519

The reported value(s) and uncertainties resulting from the measurement process are:

Report of Measurement

Range mR/hr	Applied mR/hr	T.I. Reading mR/hr
0 - 0.5	0.4	0.398
0 - 5	1.0	1.01
0 - 5	4.0	4.05
0 - 50	10.0	9.9
0 - 50	40.0	39.4
0 - 500	100	101
0 - 500	400	396
R/hr	R/hr	R/hr
0 - 5	1.0	0.99
0 - 5	4.0	4.14

- The instrument calibration results are accurate to within ±10% of reading between 10 and 100% full scale on any range, exclusive of energy response.

Victoreen
VISION • VALUE • INTEGRITY
813 Irving-Wick Drive West, Heath, Ohio 43056-6118 TEL: (740) 788-5400 FAX: (740) 788-5404